

Incorporated 1775



Historic Pioneer Valley

Town of South Hadley

DEPARTMENT OF PUBLIC WORKS
Division Of Water Pollution Control
2 James Street
Chicopee, MA 01020
Telephone (413) 538-5040
Fax (413) 536-7151

ASCE Landmark 1986



First Inclined Plane
Canal In U.S. - 1794

January 18, 2018

U.S. Environmental Protection Agency
Water Technical Unit (OES04-SMR)
5 Post Office Square – Suite 100
Boston, MA 02109- 3912

RE: Annual Nitrogen Optimization Report

Dear Sir / Madam:

Enclosed please find the above referenced report for the South Hadley Wastewater Treatment Plant, Permit #MA0100455. If you have any questions, or require any further information, I can be reached by phone at 413-315-0200, or by email at mlabonte@southhadleyma.gov.

Thank you,

Melissa LaBonte
WPC Compliance Manager
Town of South Hadley

Cc: MassDEP, Western Region
MassDEP, Worcester
Jim Reidy, SH DPW Superintendent



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South Hadley Wastewater Treatment Plant

NPDES Permit #MA0100455

Annual Nitrogen Optimization Report - 2017

1) Summary of Activities related to optimizing Nitrogen removal efficiencies

Section B of the National Pollutant Discharge Elimination System (NPDES) Permit for the South Hadley Wastewater Treatment Plant (WWTP), effective December 1, 2012, contains Special Conditions for Nitrogen. The conditions include a Nitrogen Optimization Study (completed), implementation of operational changes to maintain the mass discharge of total Nitrogen less than the existing annual average loading, and an annual report summarizing Nitrogen optimization activities, trends, and loading for the previous calendar year.

Over the course of the current Permit, the South Hadley WWTP has tried to incorporate Nitrogen Optimization in its daily operations, with varying results. The facility initially participated in the Low Cost Nitrogen Retrofit Study conducted by JJ Environmental, which was used to meet the Permit requirement for a Nitrogen Optimization Study. Over a couple of years, plant staff worked with Grant Weaver of The Water Planet to try to implement and monitor process control changes to naturally enhance Nitrogen removal utilizing existing tankage and equipment. Despite initial improvements in nitrifying and nitrate removal, each attempt ended in failure due to known deficiencies within the plant that cannot be easily overcome.

The South Hadley WWTP has a couple of limiting factors that have inhibited each attempt to operate in a way to optimize Nitrogen removal. The key limiting factor for this facility, which was identified by plant staff and reported to JJ Environmental during the Study, is low Dissolved Oxygen (D.O.) in the aeration tanks. This has been a concern since the aerators were replaced in the 2008 upgrade. Even with the aerators at full operation, it is difficult to achieve, let alone maintain, a dissolved oxygen level in the tanks over one milligram per liter (mg/L), especially in the warmer months when it is needed the most. The second factor was low influent Biochemical Oxygen Demand (BOD) to drive the process. The plant has had a long history with low influent BOD's, at one point making it difficult to meet the 85% removal required under the NPDES Permits, although there has been some improvement recently. As a result, due to these limiting factors, attempts to operate in a manner that enhances Nitrogen removal have resulted in low pH and alkalinity throughout the plant, problems with filamentous bacteria (and associated chlorine demand issues with the effluent), and septic biomass resulting in excessive odor complaints from the surrounding neighborhood. As a result of these deficiencies, and the results of past attempts, it is unlikely that this facility can effectively operate in a way to enhance Nitrogen removal without significant capital costs.

Given the physical limitations of the facility and the historical issues the facility has experienced, the plant did not attempt to operate in a way to optimize Nitrogen removal for calendar 2017. The plant still experienced low pH and alkalinity in June, and as a result still struggled with filamentous bacteria throughout the warmer months. This is most likely due to the low D.O., however lower flows due to an ongoing regional drought and significantly reduced industrial loadings may also have been contributing factors.

2) Annual Nitrogen Discharge Loading

The Nitrogen effluent data for the South Hadley WWTP for calendar year 2017 has been summarized in the attached spreadsheet and graphs. The annual average for total Nitrogen loading was 272.4 pounds per day, based on 51 data points. This is essentially the same as the 273 pounds per day annual average reported for 2016, and less than the annual average referenced in the NPDES Permit of 682 pounds per day, without any significant modifications and no Nitrogen optimization.

3) Trends relative to the previous year

The current NPDES Permit requires weekly effluent monitoring for Ammonia, Total Kjeldahl Nitrogen (TKN), Nitrate and Nitrite. The 2016 monthly data is included in the last 2 columns on the 2017 data summary as a reference. As shown on the attached graphs, with the exception of the first quarter of 2017, concentrations for the year were equal to or less than those of the preceding year. This trend did not follow through on the loading side, where the loadings were greater than or equal to 2016 for the first five months, and less than or equal to 2016 during the warmer months, before trending upward again. Extremely low flows during the summer due to the ongoing drought may have been a contributing factor.

2017 Nitrogen Data

2017 Effluent Data	Rain Inches/Day	Daily Flow MGD	Ammonia Nh3 N mg/L	TKN mg/L	Nitrate NO3 mg/L	Nitrite NO2 mg/L	Nitrogen N Total mg/L	Nitrogen N Total Lbs/day	2016	2016	Nitrogen
									Nitrogen N Total mg/L	N Total Lbs/day	
January											
1/3	0.9	2.09	1.26	2.17	16	<0.1	18.27	317.6	15.85	285.9	
1/10	0.17	1.56	2.1	3.29	14.7	<0.1	18.09	235.3	9.15	211.5	
1/17	0.36	1.71	1.68	2.59	15.6	<0.1	18.29	261.5	10.75	221.6	
1/24	No Data	2.1	2.66	3.29	15.5	0.109	18.9	330.2	11.97	199.1	
Sum			7.7	11.3	61.8	<0.41	73.55	1144.6	47.720	918.072	
Avg			1.93	2.8	15.5	<0.102	18.4	286.2	11.930	229.518	
Max			2.66	3.3	16	0.109	18.9	330.2	15.850	285.936	
Min			1.26	2.2	14.7	<0.1	18.09	235.3	9.150	199.123	
February											
2/1	0	1.9	2.59	2.87	15	<0.1	17.97	277.4	12.19	183.3	
2/7	0.42	1.8	2.24	3.99	15	0.113	19.1	288.6	12.19	215.2	
2/14	0.38	1.7	5.46	5.88	12.4	0.141	18.42	262.5	16.41	394.9	
2/21	0	2.3	3.22	5.11	9.94	0.13	15.18	290.3	12.08	265.3	
2/28	0.02	2.6	2.52	3.71	9.9	0.132	13.74	299			
Sum			15.76	21.6	62.24	<0.616	84.41	1417.8	52.870	1,058.756	
Avg			3.15	4.3	12.45	<0.123	16.88	283.6	13.218	264.689	
Max			5.46	5.9	15	0.141	19.1	299	16.410	394.941	
Min			2.24	2.9	9.9	<0.1	13.7	262.5	12.080	183.274	
March											
3/7	0.14	2.08	6.44	8.12	8.84	0.218	17.18	298.5	10.66	280.4	
3/14	0	1.85	5.39	7.7	11.1	0.205	19.01	293.8	13.8	300.7	
3/21	0	2.06	6.79	7.98	12	0.225	20.21	346.6	17.03	488.2	
3/28	0.59	3.09	11.6	12.2	5.52	0.257	17.98	462.6	13.23	274.8	
Sum			30.22	36	37.46	0.905	74.38	1401.5	72.520	1,740.207	
Avg			7.6	9	9.4	0.23	18.6	350.4	14.504	348.041	
Max			11.6	12.2	12	0.26	20.2	462.7	17.800	488.159	
Min			5.4	7.7	5.5	0.21	17.2	293.8	10.660	274.767	
April											
4/4	0.28	5.2	2.87	3.57	4.98	0.226	8.78	380.2	16.46	304.2	
4/11	0	3.1	0.28	0.91	9.01	<0.1	10.02	255.3	15.25	338.2	
4/18	0	2.4	2.87	3.78	11.6	0.111	15.49	304.8	16.86	289.3	
4/26	0.06	3	4.2	4.69	11.2	0.25	16.14	402.5	14.37	285.5	
Sum			10.22	13	36.79	<0.69	50.43	1342.7	62.940	1217.17	
Avg			2.56	3.24	9.2	<0.17	12.61	335.7	15.735	304.29	
Max			4.2	4.7	11.6	0.25	16.14	402.5	16.860	338.21	
Min			0.28	0.9	4.98	<0.1	8.78	255.3	14.370	285.45	

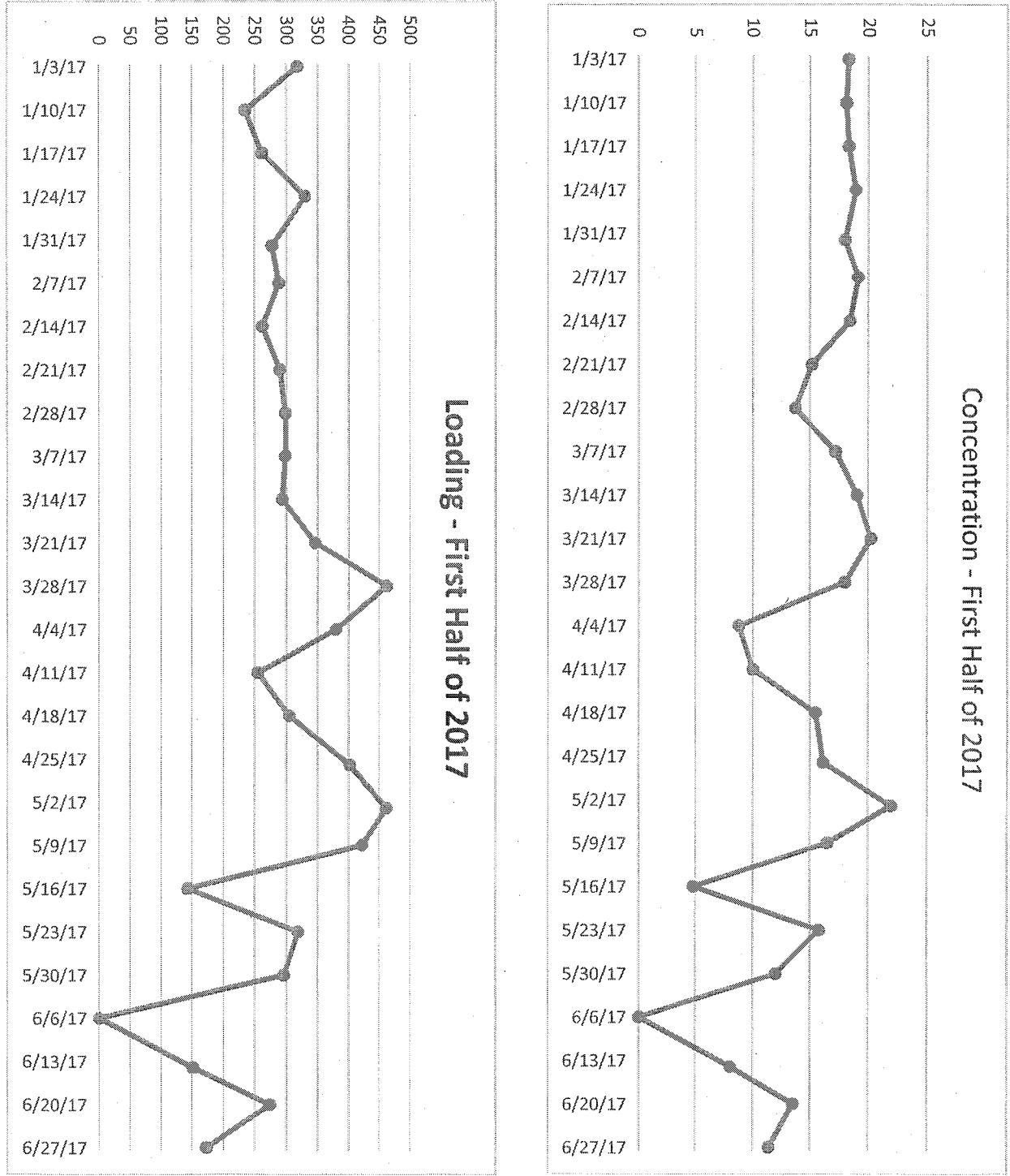
2017 Nitrogen Data

2017 Effluent Data	Rain Inches/Day	Daily Flow MGD	Ammonia Nh3 N mg/L	TKN mg/L	Nitrate NO3 mg/L	Nitrite NO2 mg/L	Nitrogen N Total mg/L	Nitrogen N Total Lbs/day	2016	2016	Nitrogen
									Nitrogen N Total mg/L	N Total Lbs/day	
May											
5/3	0	2.53	2.95	4.87	16.7	0.349	21.9	461.7	10.6	195.8	
5/9	0	3.07	1.01	3.47	12.9	0.154	16.5	422.9	13.7	198.2	
5/16	0	3.59	0.15	1.99	2.73	<0.1	4.8	143.6	17.1	307.4	
5/23	0	2.42	0.83	2.9	12.75	0.121	15.8	318.9	22.3	356.9	
5/30	0.02	2.96	0.15	2.02	9.83	<0.1	12	296.1	22.3	265.7	
Sum			5.09	15.3	54.91	<0.82	71	1643.2	86.000	1,323.943	
Avg			1.02	3.1	10.98	<0.16	14.2	328.6	17.200	264.789	
Max			2.95	4.9	16.7	0.35	21.9	461.7	22.300	356.889	
Min			0.15	2	2.73	<0.1	4.8	143.6	10.600	195.801	
June											
6/6	1.1	4.5	No Data	No Data	6.68	<0.6	No Data	No Data	No Data	No Data	
6/14	0	2.27	0.14	1.46	6.47	<0.1	8.03	152.2	25.9	308.6	
6/20	0	2.44	0.26	2.91	10.5	<0.1	13.51	274.4	24.2	289.1	
6/27	0.14	1.83	0.11	2.81	8.47	<0.1	11.38	173.2	21.3	260.9	
Sum			0.51	7.2	32.12	<0.9	32.92	599.83	71.400	858.664	
Avg			0.17	2.39	8.03	<0.22	10.97	199.94	23.800	286.221	
Max			0.26	2.9	10.5	<0.6	13.51	274.42	25.900	308.610	
Min			0.11	1.5	6.47	<0.1	8.03	152.18	21.300	260.912	
July											
7/4	0	1.51	0.16	1.97	7.54	<0.1	9.61	120.7	16.27	214	
7/14	0.75	1.71	0.24	3.66	<0.1	<0.1	3.86	55.04	27.17	324	
7/18	0.62	1.56	0.22	2.27	5.76	<0.1	8.13	105.5	25.53	304.2	
7/25	0	1.2	0.16	2.63	5.96	<0.1	8.69	86.9	23.39	278.7	
Sum			0.78	10.5	<19.36	<0.4	30.29	368.13	92.360	1,120.874	
Avg			0.2	2.63	<4.84	<0.1	7.57	92.03	23.090	280.219	
Max			0.24	3.7	7.54	<0.1	9.61	120.7	27.170	323.964	
Min			0.16	2	<0.1	<0.1	3.86	55.04	16.270	214.006	
August											
8/1	0	1.3	0.59	2.8	8.68	0.104	11.58	125.8	21.42	321.9	
8/8	0	1.54	0.68	3.54	11.6	0.25	15.39	197.2	19.43	231.4	
8/15	0	1.47	3.01	6.31	12.1	0.434	18.84	231.2	23.41	278.9	
8/22	0.45	1.42	3.83	7.01	14.2	0.802	22.01	260.7	11.82	140.8	
8/29	0.02	1.39	2.38	7.34	17.7	0.516	25.56	295.8	13.74	163.3	
Sum			10.49	27	64.28	2.11	93.38	1110.6	89.820	1,136.281	
Avg			2.1	5.4	12.86	0.42	18.68	222.12	17.964	227.256	
Max			3.83	7.3	17.7	0.8	25.56	295.76	23.410	321.871	
Min			0.59	2.8	8.68	0.1	11.58	125.77	11.820	140.841	

2017 Nitrogen Data

2017 Effluent Data	Rain Inches/Day	Daily Flow MGD	Ammonia Nh3 N mg/L	TKN mg/L	Nitrate NO3 mg/L	Nitrite NO2 mg/L	Nitrogen N Total mg/L	Nitrogen N Total Lbs/day	2016 Nitrogen N Total mg/L	2016 N Total Lbs/day	Nitrogen Total Lbs/day
September											
9/5	0.24	1.66	0.83	3.61	16.9	0.482	21	290.7	15.94	189.7	
9/12	0	1.45	1.32	5.35	0.614	<0.1	6.1	73.8	25.3	266.6	
9/19	0	1.53	4.62	7.78	12.6	0.767	21.1	269.2	24.33	282.1	
9/26	0	1.36	1.55	3.55	12.7	0.344	16.6	188.3	15.06	182.1	
Sum			8.32	20.29	42.814	1.693	64.8	822	80.630	920.531	
Avg			2.1	5.1	10.7	0.42	16.2	205.5	20.158	230.133	
Max			4.62	7.78	16.9	0.767	21.1	290.7	25.300	282.118	
Min			0.83	3.55	0.614	<0.1	6.1	73.8	15.060	182.144	
October											
10/3	0	1.3	0.17	2.78	17.8	<0.1	20.7	224.4	19.96	218.2	
10/10	0	1.5	5.49	8.47	13	0.753	22.2	277.7	18.87	180.4	
10/18	0	1.3	10.1	12.4	11	0.736	24.1	261.3	25.39	283.8	
10/24	3.58	2	8.6	12.2	14.8	0.581	27.6	460.4	29.93	306.5	
10/31	0	3	0.24	2.58	11.3	<0.1	14	350.3			
Sum			24.6	38.4	67.9	<2.27	108.6	1574.1	94.150	988.867	
Avg			4.92	7.69	13.6	<0.45	21.72	314.82	23.538	247.217	
Max			10.1	12.4	17.8	0.753	27.6	460.4	29.930	306.529	
Min			0.17	2.6	11	<0.1	14	224.4	18.870	180.353	
November											
11/7	0.06	2	0.13	1.79	13.2	<0.1	15.09	251.7	29.77	295.1	
11/14	0	1.8	0.18	1.98	14.1	<0.1	16.18	244.5	25.09	260.3	
11/19	0	2	0.17	2.81	20.8	<0.1	23.71	395.5	27.05	365.5	
11/28	0	1.6	0.3	3.5	14	<0.1	17.6	241.2	26.94	376.5	
Sum			0.78	10.1	62.1	<0.4	72.58	1132.9	132.540	1,647.372	
Avg			0.2	2.5	15.5	<0.1	18.15	283.2	26.508	329.474	
Max			0.3	3.5	20.8	<0.1	23.71	395.5	29.770	376.543	
Min			0.13	1.8	13.2	<0.1	15.09	241.2	23.690	260.285	
December											
12/5	0.45	1.86	0.26	2.2	18.1	<0.1	20.4	317.25	18.37	233	
12/12	0.39	2.03	0.77	3.29	19.1	0.194	22.6	383.09	22.53	274.9	
12/19	0	1.81	0.48	2.21	19.2	<0.1	21.5	324.61	21.49	247.4	
12/26	0	1.9	0.27	2.22	17.2	<0.1	19.5	309.7	21.77	314.3	
Sum			1.78	9.92	73.6	<0.494	84	1334.64	84.160	1,069.668	
Avg			0.445	2.48	18.4	<0.124	21	333.66	21.040	267.417	
Max			0.77	3.29	19.2	0.194	22.6	383.09	22.530	314.336	
Min			0.26	2.2	17.2	<0.1	19.5	309.7	18.370	232.976	

2017 Nitrogen Data



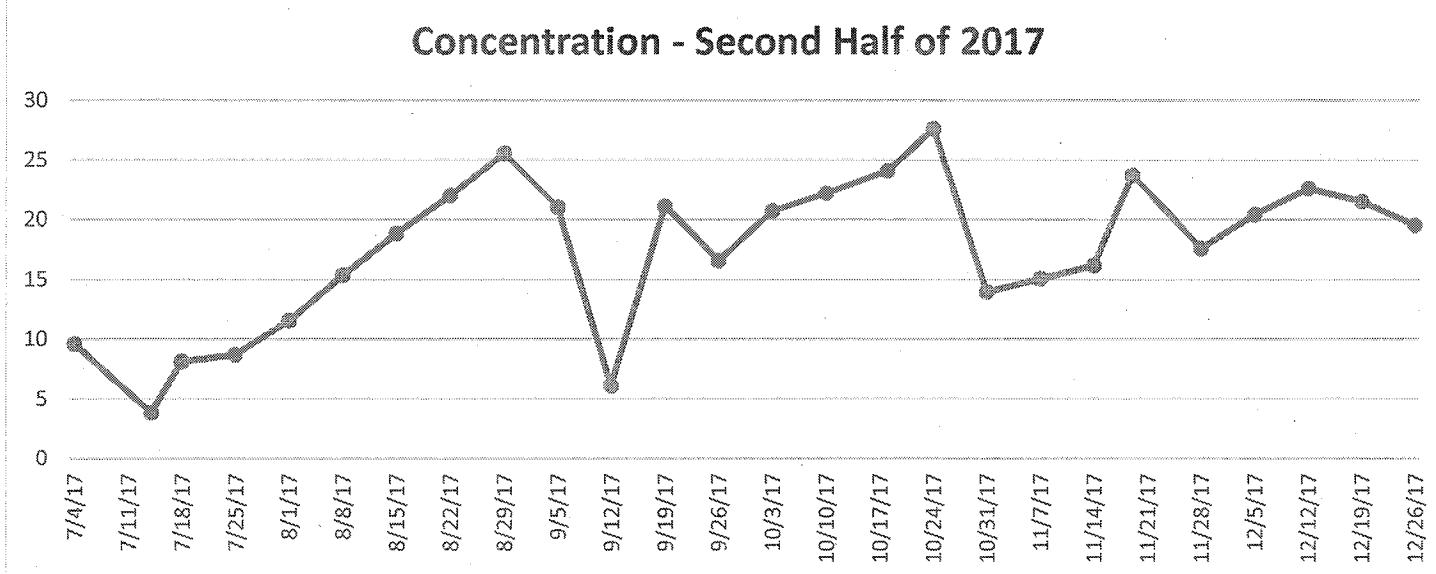
Loading - First Half of 2017

2017 Effluent Data	2017 Nitrogen N Tot mg/L	2017 Nitrogen N Tot Lbs/day
1/3/17	18.27	317.6
1/10/17	18.09	235.3
1/17/17	18.29	261.5
1/24/17	18.9	330.2
2/1/17	17.97	277.4
2/7/17	19.1	288.6
2/14/17	18.42	262.5
2/21/17	15.18	290.3
2/28/17	13.74	299
3/7/17	17.18	298.5
3/14/17	19.01	293.8
3/21/17	20.21	346.6
3/28/17	17.98	462.6
4/4/17	8.78	380.2
4/11/17	10.02	255.3
4/18/17	15.49	304.8
4/25/17	16.14	402.5
5/2/17	21.9	461.7
5/9/17	16.5	422.9
5/16/17	4.8	143.6
5/23/17	15.8	318.9
5/30/17	12	450
6/6/17	No Data	400
6/14/17	8.03	152.2
6/20/17	13.51	274.4
6/27/17	11.38	173.2

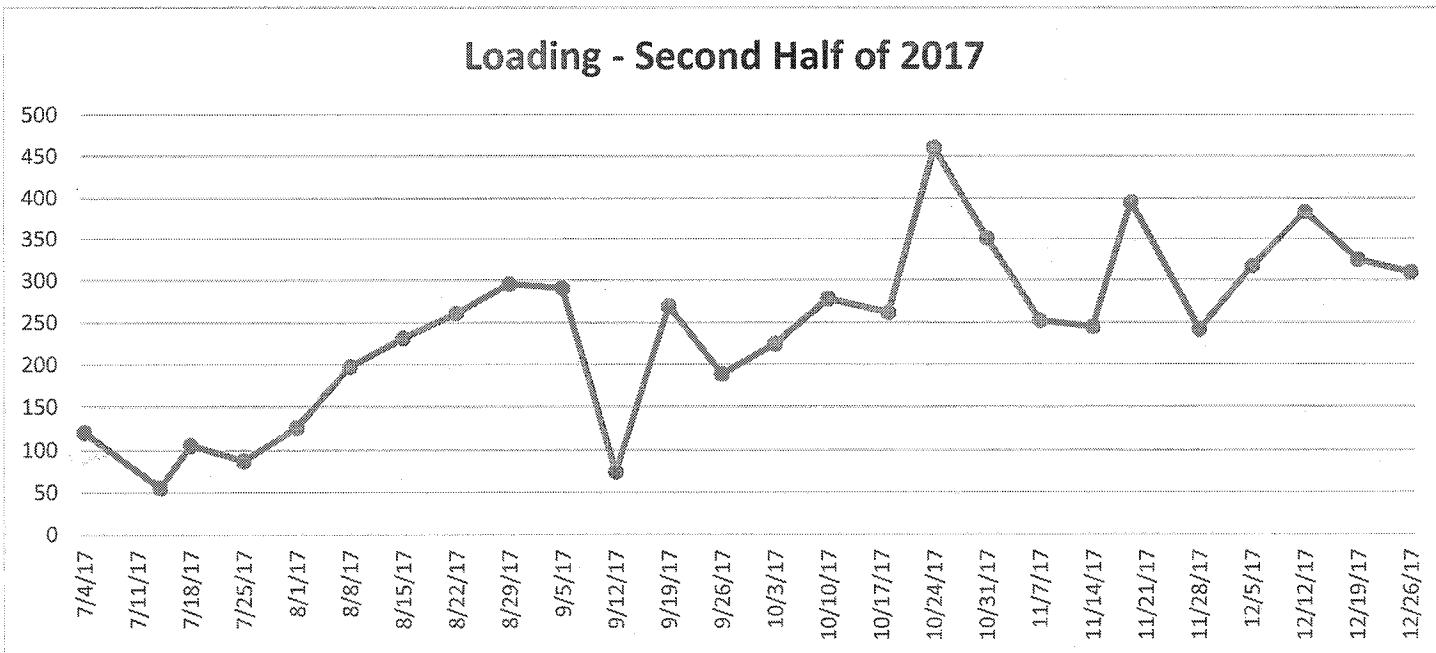
2017 Nitrogen Data

2017 Effluent Data	2017 Nitrogen N Tot mg/L	2017 Nitrogen N Tot Lbs/day
7/4/17	9.61	120.7
7/14/17	3.86	55.04
7/18/17	8.13	105.5
7/25/17	8.69	86.9
8/1/17	11.58	125.8
8/8/17	15.39	197.2
8/15/17	18.84	231.2
8/22/17	22.01	260.7
8/29/17	25.56	295.8
9/5/17	21	290.7
9/12/17	6.1	73.8
9/19/17	21.1	269.2
9/26/17	16.6	188.3
10/3/17	20.7	224.4
10/10/17	22.2	277.7
10/18/17	24.1	261.3
10/24/17	27.6	460.4
10/31/17	14	350.3
11/7/17	15.09	251.7
11/14/17	16.18	244.5
11/19/17	23.71	395.5
11/28/17	17.6	241.2
12/5/17	20.4	317.25
12/12/17	22.6	383.09
12/19/17	21.5	324.61
12/26/17	19.5	309.7

Concentration - Second Half of 2017

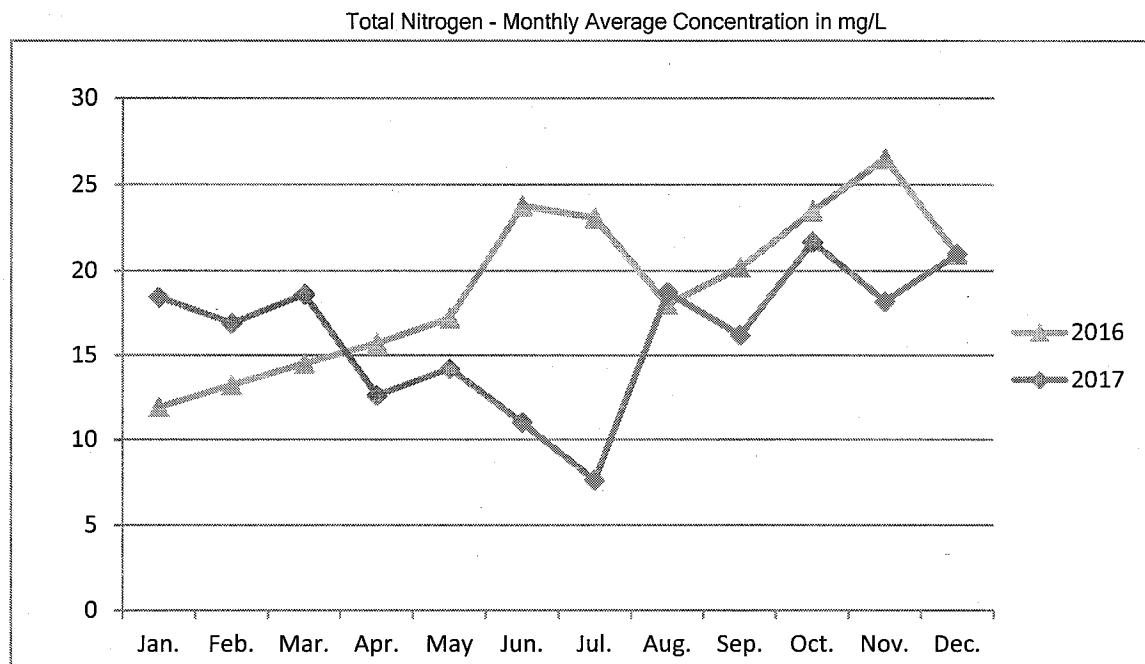


Loading - Second Half of 2017



2016 - 2017 Monthly Average Nitrogen Data

	2016 Nitrogen N Tot mg/L	2016 Nitrogen N Tot Lbs/day
Jan.	11.9	229.5
Feb.	13.2	264.7
Mar.	14.5	348
Apr.	15.7	304.3
May	17.2	264.8
Jun.	23.8	286.2
Jul.	23.1	280.2
Aug.	18	227.3
Sep.	20.2	230.1
Oct.	23.5	247.2
Nov.	26.5	329.5
Dec.	21	267.4



	2017 Nitrogen N Tot mg/L	2017 Nitrogen N Tot Lbs/day
Jan.	18.4	286.2
Feb.	16.9	283.6
Mar.	18.6	350.4
Apr.	12.6	335.7
May	14.2	328.6
Jun.	11	199.9
Jul.	7.6	92
Aug.	18.7	222.1
Sep.	16.2	205.5
Oct.	21.7	314.8
Nov.	18.2	283.2
Dec.	21	333.7

